wood in an early stage of dry rot, while others depict the spores of the fungus. The life-history of Merulius forms the subject of the third chapter, in the course of which it is shown that moisture aids in its development and spread. The mode in which it affects wood, and the manner of its propagation, are discussed in subsequent chapters, after which the best methods of prevention are taken into consideration. A second and much shorter section of the work is devoted to the nature and ravages of *Polyporus vaporarius* and other wood-destroying funguses. R. L.

How to Work Arithmetic. Parts i. and ii. By Leonard Norman. Second Edition. Pp. xvi + 77 in each part. (Rugby: G. E. Over, 1902.) Price 1*s.* 6*d.* net each.

THESE small volumes contain the same series of 136 "model problems worked in full by elementary, and advanced methods" respectively. In part ii., the shorter method of long division is adopted, which makes it preferable to part i., even for beginners; and questions which are solved by the "unitary method" in part i. are solved by "proportion" in part ii. The problems are, many of them, of a somewhat old-fashioned and useless character, and while the range is fairly comprehensive, the omission of examples of methods of approximation seems remarkable. There is a misprint in the recurring decimals which are "worth knowing"; the terms "odd" and "even" instead of "alternate" in the test of divisibility by 11 are apt to be misleading. Every pupil with a good teacher ought to make a collection like this for himself, but the books should prove useful to self-taught students.

Untersuchungen über den Lichtwechsel Algols. By Ant. Pannekoek. Pp. xxiv+236. (Leyden: L. van Nifterik, 1902.)

IN this volume the author has collected and discussed the chief observations of Algol that have been made since the publication of John Goodricke's results in 1783.

The observations of Plassman, Argelander, Heis, Müller, Wilsing, the author and others are included, and the various methods of obtaining and interpreting the results are analysed and compared.

The construction of comparison-star light scales, photometric measurements, the magnitudes at, and the duration of, the maxima and minima, the construction of the light curves and their asymmetry, are amongst the other subjects which are discussed in detail.

There are two appendices, the first of which deals with the corrections which have to be applied to these observations, whilst the second gives the details of the observations of Plassman, Pannekoek, Argelander and Heis respectively, in tabular form. W. E. R.

My Nature Notebook. By E. Kay Robinson. Pp. ii +211. (London: Isbister and Co., Ltd., 1903.) Price 2*s.* 6*d.*

DURING 1902, Mr. Robinson contributed weekly a series of interesting "nature notes" to the *Daily Graphic*, and the fifty-two instalments are here re-published in book form. Under each week are to be found five or six short paragraphs, describing in a chatty way certain aspects of nature noticeable at that period of the year. To the intelligent person living in the country, such a book as this should prove of great use, for under the author's guidance there will be no difficulty in knowing what and how to observe, and quite a short experience of such personal observation will develop a love for plants and animals of many kinds.

LETTERS TO THE EDITOR.

The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*]

Can Dogs Reason?

THE answer to the question, "Can an animal reason?" depends upon the sense in which the word "reason" is used. If dog-stories are to be accepted as evidence, the question must be answered in the affirmative, even though the most liberal, and human, significance be attached to the word. It is, however, of great importance that data should be obtained under conditions which can be rigidly controlled, in order that the credibility of anecdotes may be tested by the results of observations which can be easily repeated. Already excellent work has been done in this field by Lloyd Morgan, Thorndike, Small, Mills, Hobhouse, and others, but the science of animal psychology is still in its infancy.

That an animal can compare a sensation newly received with memories of sensations, and form a perceptual judgment, which leads to action suitably adapted to its circumstances, no one doubts; but this is hardly reasoning in the usually accepted meaning of the term. We may, for the sake of simplicity, term the forming of a perceptual judgment putting one and one together. But can an animal compare an inference with an inference? Is it capable of what we term the syllogism, when speaking of human thought? Can it "put two and two together" within the

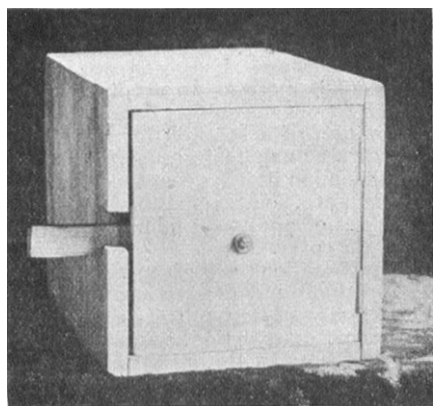

FIG. 1.

common meaning of this phrase? I am, of course, conscious of the absurdity of applying the term syllogism to the wordless thought of an animal, and also of the fact that a perceptual judgment may be expressed in syllogistic form, but my meaning will, I think, make itself sufficiently clear in the description of the following experiment:—

An exceptionally intelligent fox terrier was taught to open a box by lifting a wooden latch with its nose. Some care was spent upon the design of this box (Fig. 1). The latch was in the first instance long, and therefore easily lifted. Behind the door was placed a spiral spring, which could be twisted until it exerted any degree of pressure which seemed desirable. As the dog learnt to lift the latch, the length of the latch was curtailed. At the same time the spring was tightened until it pressed against the door with a degree of force which made the latch so stiff that the dog could not lift it without deliberate effort. There was no risk of its being opened by a chance movement. The dog was rewarded with food for performing the trick, which soon became so familiar as to be a game. As often as the door was closed the dog opened it. If he found the box on the floor he invariably opened it without waiting for any sign.

Frequently he examined the interior of the box when he had opened it, but food was never placed inside it. One evening, after the trick had been shown to a number of friends in order that the dog's almost ridiculous familiarity with it might be noted, Peter was sent to bed without his supper. He is fed but once a day. Next morning a hot grilled bone was placed in the box. The box was placed in a small yard surrounded by the house. The "boot-room" opens into the yard on one side, and into a passage on the other. After the dog had had a run in the garden the passage door into the boot-room was opened. We were watching the yard from an upper window. Two minutes after entering the boot-room Peter smelled the bone, ran through into the yard, and approached the box. When he saw the latch he ducked his head as if intending to lift it, but desisted. He then sniffed excitedly at the box and pushed it with his nose. He returned to the boot-room. After a few minutes he came out again into the yard and sniffed in the same way at the box. Twice he pushed the latch from behind, but did not put his head beneath it. After a while he returned to the boot-room and showed no signs of revisiting the box. He was then taken for a twelve-mile run in the country. As he seemed to be tired when he reached home, he was left for half an hour in the boot-room to rest. After a run in the garden, he was re-admitted to the boot-room, with the yard-door open. Unluckily the wind blew the door to before Peter had gone into the yard. After we had watched for some time my son went down to see what had happened—opened the door and pushed the dog through it, backwards. He went straight to the box, lifted the latch in the most business like way, and took out the bone.

The experiment was repeated a fortnight later with identical results. The dog ran into the yard, sniffed at the box, pushed it with his nose, was very eager to get the meat, but, this time, he showed no sign of remembering the way to open the box. He returned a second time, and then desisted altogether. During the morning the dog remained about the house. He constantly asked to be admitted into the boot-room, and showed in the clearest manner that he remembered that the grilled bone was to be found that way. At twelve o'clock the door was opened for him. He went straight through into the yard, opened the box, and took out the bone, which he attacked without any sign of doubting his legal right to its possession. It may be noticed that he is frequently fed in this yard.

In this experiment the dog knew two things. He knew how to open the box. Indeed, the sight of the latch was so strongly associated in the dog's mind with the action of lifting it that it is surprising that the usual, almost mechanical, response to sensation did not occur. Had he lifted the latch it would not necessarily have implied that he did it with the object of securing the food. He knew that the box contained meat. Eager as he was to secure the meat, he did not reason "The way to secure the meat is to lift the latch." I have described the experiment in detail, because all details are, as it appears to me, of great importance. It is to be noted that the opening of the box was associated in the dog's mind with the approbation of a human being. Great care was taken that no person should be present when the dog found the box. The sight of the box was strongly suggestive to the dog's mind of the action of opening it. With a view to diminishing the urgency of this sensori-motor association, a piece of hot meat with a strong "brown smell" was placed in the box. Its rich scent distracted his attention from the latch. When the dog was readmitted to the yard later in the morning, he was aware that the box was in the yard, and he went straight from a person to the box. By this time the bone was cold, and its scent less striking. It is impossible to repeat the experiment upon Peter, because now, when he opens the box, he invariably searches for food inside it. But I should be grateful to any of your readers who would repeat this experiment, taking great care (1) that the opening of the box is not associated in the dog's mind with finding food inside it, and (2) that, when the dog finds the box containing food, he is quite alone. I need hardly add that I shall be still more grateful to anyone who will suggest to me another test of the same kind. ALEX. HILL.

Downing College Lodge, Cambridge.

Spherical Aberration of the Eye.

AN account of the recognised methods of investigating the spherical aberration of the eye is given by Tscherning, "Rapports presentés au Congrès international de Physique réuni à Paris en 1900," tome iii., pp. 551–557. These methods for the most part require special experimental appliances, and for some to succeed it is necessary to resort to cocaine or homatropine injections in order to increase the size of the pupil. The following method, which requires no special apparatus or preparation, appears to have escaped observation, and may therefore be worth describing. Place a piece of white paper, on which a broad black band has been ruled horizontally, just beyond the shortest distance of distinct vision from the eye, and while looking at the upper edge of the black band, cover the pupil progressively from below by means of a card with its upper edge horizontal, placed as near as possible to the eye. At the moment when the pupil is all but completely covered, the edge of the black band will be seen to suffer a depression, its original position being regained on uncovering the pupil. On raising and lowering the card at a rate of once or twice a second, this displacement is very marked. The best success is obtained in a fairly dim light, when the pupil is expanded; care must be taken to keep the eye carefully focused on the edge of the black band, or an exaggerated displacement, due to relaxation of the accommodation of the eye, may result. The above experiment shows that, when accommodated for near vision, the optical system of the eye is over-corrected for spherical aberration, the rays transmitted near the edge of the pupil being insufficiently deviated. To prove this, let us suppose the edge of the black band to be situated on a continuation of the optic axis of the eye. Then, provided the accommodation of the eye is correct, the rays traversing the middle of the pupil will form an image of the edge of the black band at that point of the retina which is cut by the optic axis. If the rays transmitted through the upper peripheral portion of the pupil are insufficiently deviated, they will cut the retina at a point above the true image, and owing to the mental inversion of retinal images, an image apparently below the true image will be observed. On covering up the pupil from below, the true image is obscured, and that formed by the rays traversing the upper edge of the pupil is alone seen.

On repeating the above experiment, when the eye is fixed on a distant object, the image of the latter will apparently rise, showing that it really sinks, as the pupil is covered from below. This proves that, when at rest, the optical system of the eye is under-corrected for spherical aberration, thus resembling an ordinary lens.

If an image of a gas flame is formed on a white card by means of a lens of three or four inches focus, the depression of the image on the card, as the lens is progressively covered from below, can easily be observed. EDWIN EDSER.

April 2.

The Name Solenopsis.

IT appears from your issue of March 19 (p. 480) that Dr. Wheelton Hind was to read a paper before the Geological Society on March 25, on a new species of Solenopsis. We have here an illustration of the extraordinary persistence of an untenable name. The name Solenopsis was bestowed by Westwood in 1841 (*An. Mag. Nat. Hist.*, vi. p. 86) on a very common and well-known genus of ants. In 1844 McCoy gave the same name to the genus treated of by Dr. Hind, which consists of Mollusca occurring fossil in the Carboniferous rocks. This Molluscan genus (which was made the type of a family Solenopsidæ by Neumayr) cannot possibly retain the name it bears, and it may be called Solenomorpha.

I observe, that recently Reiffen has proposed the name Ludwigia for a genus of echinoderms. The same name was bestowed by Pic in 1893 on a group of beetles. More strange is Distant's recent proposal of Melania for a genus of Coreid bugs, this being the name of one of the best-known of Molluscan genera!

T. D. A. COCKERELL.

E. Las Vegas, N.M., U.S.A., April 2.